Patent claims

1. Orbital welding device for mobile use for joining a first pipe end (1) and a second pipe end (2) along a circumferential joint (3) by means of at least one weld seam (4), in particular for producing a pipeline (5) to be laid on land comprising at least

   - a guide ring (6) which can be oriented relative to the first pipe end (1) and the circumferential joint (3),
   - an orbital carriage (7) displaceably guided at least along a section of the guide ring (6),
   - a feed device (8) by means of which the orbital carriage (7) can be moved under motor power along the guide ring (6),
   - a welding head which is arranged on the orbital carriage (7) and can be aligned with the circumferential joint (3) so that, by moving the orbital carriage (7), the weld seam (4) can be produced at least along a section of the circumferential joint (3),
   - a connecting line and
   - a welding device - in particular a mobile welding device - which is a distance away from the orbital carriage (7) and is connected via the connecting line to the welding head and indirectly or directly provides the power required for producing the weld seam (4),

   characterized in that

   - the welding device is in the form of a high-

power fibre laser beam source (9), by means of which a laser beam (10) can be produced,

- the connecting line is in the form of a waveguide (11) for guiding the laser beam (10) to the orbital carriage (7) and
- the welding head is in the form of a laser welding head (12) for directing the laser beam (10) into a laser welding zone (13) and for the consequent production of the weld seam (4).

2. Orbital welding device according to Claim 1, characterized in that

- the guide ring (6) is designed so as to be capable of being arranged on the outer surface (14) of the first pipe end (1) and
- the weld seam which can be produced is in the form of an outer weld seam (4).

3. Orbital welding device according to Claim 1 or 2, characterized by at least

- a process gas nozzle (20) arranged indirectly or directly on the orbital carriage (7) and intended for supplying process gas to the region of the laser welding zone (13),
- a process gas line (21) and
- a process gas store (22) - in particular mobile process gas store - which is a distance away from the orbital carriage (7) and is connected via the process gas line (21) to the process gas nozzle (20) for the supply of process gas.

4. Orbital welding device according to any of Claims 1 to 3, characterized by at least

- a wire nozzle (23) arranged indirectly or directly on the orbital carriage (7) and intended for supplying a wire (24) into the laser welding zone (13),
- a wire feed line (25) and
- a wire feed unit (26) - in particular a mobile wire feed unit - which is a distance away from the orbital carriage (7) and is connected via the wire feed line (25) to the wire nozzle (23) for supplying wire.

5. Orbital welding device according to Claim 4, characterized by a wire heating unit (27) located upstream of the wire nozzle (23) and intended for heating the wire (24).

6. Orbital welding device according to Claim 1 or 2, characterized by at least

- an MSG arc welding head (28) which is arranged indirectly or directly on the orbital carriage (7) and can be aligned under motor power in particular relative to the orbital carriage (7),
- an MSG power line (29),
- an MSG process gas store (30),
- an MSG wire feed line (31),
- an MSG power source (32) - in particular a mobile and freely programmable MSG power source - which is a distance away from the orbital

carriage (7) and is connected via the MSG power line (29) to the MSG arc welding head (28) for forming the MSG arc,

- an MSG process gas store (30) - in particular mobile MSG process gas store - which is a distance away from the orbital carriage (7) and is connected via the MSG processing gas line (30) to the MSG arc welding head (28) for supplying the MSG process gas, and
- an MSG wire feed unit (34) - in particular mobile MSG wire feed unit - which is a distance away from the orbital carriage (30) and is connected via the MSG wire feed line (31) to the MSG arc welding head (28) for supplying the MSG wire.

7. Orbital welding device according to Claim 6, characterized in that the MSG arc welding head (26) is arranged indirectly or directly on the orbital carriage (7) in such a way that the laser beam (10) and the MSG arc cooperate in the laser welding zone (13).

8. Orbital welding device according to Claim 6, characterized in that the MSG arc welding head (28) is arranged indirectly or directly on the orbital carriage (7) in such a way that the laser beam (10) and the MSG arc act in separate process zones.

9. Orbital welding device according to any of Claims 1 to 8 characterized by

- an orbital position sensor (18) for detecting the orbital position (α) of the orbital carriage (7) and
- a first process parameter control (19) which is formed and is connected to the orbital position sensor (18) and at least to the high-power fibre laser beam source (9) - and in particular to the MSG power source (32) and the feed device (8) - in such a way that laser radiation parameters - and in particular MSG arc parameters and the speed of advance of the orbital carriage (7) - can be automatically adapted as a function of the orbital position (α) of the orbital carriage (7).

10. Orbital welding device according to any of Claims 1 to 9, characterized by

- a seam tracking sensor (15) which is arranged indirectly or directly on the orbital carriage (7) - in particular so as to be ahead of the intended laser welding zone (13) - in such a way that the position of the circumferential joint (3) relative to the intended laser welding zone (13) can be detected,
- adjusting means (16) by means of which the laser beam (10) - and in particular the wire nozzle (23) or the MSG arc welding head (28) - can be oriented relative to the circumferential joint (3), and
- a position control (17) which is formed and is connected to the seam tracking sensor (15) and the adjusting means (16) in such a way that the

orientation of the laser beam (10) - and in particular of the wire nozzle (23) or of the MSG arc welding head (28) can be automatically regulated as a function of the detected position of the circumferential joint (3).

11. Orbital welding device according to any of Claims 1 to 10, characterized by

- a process sensor (40) arranged indirectly or directly on the orbital carriage (7) - in particular on the laser welding head (12) - in such a way that electromagnetic radiation - in particular thermal radiation, optical radiation or plasma radiation - from the laser welding zone (13) can be detected, and
- a second process parameter control (41) which is formed and is connected to the process sensor (40) and at least the high-power fibre laser beam source (9) - and in particular to the MSG power source (32), the feed device (8) and the adjusting means (16) - in such a way that laser radiation parameters - and in particular MSG arc parameters, the speed of advance of the orbital carriage (7) and the orientation of the laser beam (10) - can be automatically adapted as a function of the detected radiation.

12. Orbital welding device according to any of Claims 1 to 11, characterized by

- an optical seam quality sensor (38) arranged indirectly or directly on the orbital carriage

(7), tracking the laser welding zone (13) and intended for making optical recordings of the weld seam (4) produced and

- logging means (39) which are connected to the seam quality sensor (38) for storage and optical playback of the recordings of the weld seam (4) produced.

13. Orbital welding device according to Claim 12, characterized by image processing means (42) which are formed and are connected to the logging means (39) in such a way that the recordings of the weld seam (4) produced can be electronically evaluated and an evaluation signal which is associated with the quality of the weld seam (4) can be output.

14. Orbital welding device according to Claim 13, characterized by a third process parameter control (43) which is formed and is connected at least to the image processing means (42) and the high-power fibre laser beam source (9) - and in particular to the MSG power source (32), the feed device (8) and the adjusting means (16) - in such a way that laser radiation parameters - and in particular MSG arc parameters, the speed of advance of the orbital carriage (7) and the orientation of the laser beam (10) - can be automatically adapted as a function of the evaluation signal.

15. Orbital welding device according to any of Claims 1 to 14, characterized by a transport vehicle (35) which can be moved longitudinally under motor

power outside the first pipe (1) and the second pipe (2) and on which at least

- the high-power fibre laser beam source (9),
- a generator (36) at least for generating the power required for operating the high-power fibre laser beam source (9) and
- a cooling system (37), coordinated at least with the high-power fibre laser beam source (9),

and in particular

- the process gas store (22),
- the wire feed unit (26),
- the MSG power source (32),
- the MSG process gas store (33) and
- the MSG wire feed unit (34)

are arranged so that the orbital welding device can be operated in a substantially stand-alone mobile manner.

16. Transport vehicle (35) of an orbital welding device according to Claim 15, characterized in that

- a high-power fibre laser beam source (9),
- a generator (36) at least for generating the power required for operating the high-power fibre laser beam source (9) and
- a cooling system (37) coordinated at least with the high-power fibre laser beam source (9)

are arranged on the transport vehicle (35).

17. Transport vehicle (35) according to Claim 16,

characterized in that

- a process gas store (22) and
- a wire feed unit (26) are arranged on the transport vehicle (35).

18. Transport vehicle (35) according to Claim 16, characterized in that

- an MSG power source (32),
- an MSG process gas store (33) and
- an MSG wire feed unit (34)

are arranged on the transport vehicle (35).